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FORM-CLASS VOLUME TABLES FOR ESTIMATING BOARD-FOOT CONTENT OF NORTHERN CONIFERS

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FORM-CLASS VOLUME TABLES FOR ESTIMATING BOARD-FOOT CONTENT OF NORTHERN CONIFERS

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INTRODUCTION

THE TIMBER CRUISER counts volume tables among his most important working tools. He wants--if he can get them--tables that are simple, easy to use, and accurate. Before using a volume table in a new situation, the careful cruiser will check it by comparing table volumes with actual volumes.

In the past, the cruiser has had a difficult problem in selecting the table to use. Many tables were available. But they were prepared for different species, to various limits of merchantability, and in various units of measure. This resulted in confusion. It was especially annoying to the cruiser who needed nothing more than a good working tool, and was not interested in extreme precision or in the fine details of table construction.

So when the Mesavage-Girard volume tables were published in 1946,[1] cruisers welcomed them enthusiastically. They promised to be useful for all species and in all regions. And they were easy to use. The cruiser had only to obtain average Girard form class (the ratio of inside-bark diameter at top of 16-foot butt log to diameter breast high) and look in the proper table. Mesavage and Girard reported that their table volumes agreed phenomenally well with measured volume: among 44 species groups the largest difference was 5.2 percent, and three fourths of them differed by less than 1.5 percent.

Unfortunately the northern conifers (red pine, white pine, spruce, fir, hemlock, and cedar) were not among the species groups for which these tables were prepared. "The tables...have been compiled for use in...eastern hardwoods and...southern hardwoods and softwood timber," Mesavage and Girard said.

To determine if these tables are usable for northern conifers, the author compared measured taper and volume with the taper and volume data reported by Mesavage and Girard. These comparisons show that the Mesavage-Girard tables should be used very cautiously--if at all--in northern softwoods.

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[1] MESAVAGE, CLEMENT, AND GIRARD, JAMES W. TABLES FOR ESTIMATING BOARD-FOOT VOLUME OF TIMBER. 94 PP. U.S. FOREST SERVICE. WASHINGTON. 1946.

HOW MESAVAGE-GIRARD VALUES COMPARE WITH MEASURED VALUES

Taper

MESAVAGE AND GIRARD used uniform taper above the first log as their basis for computing volume. If Girard form class is measured (or estimated) properly, there should be no error in the volume of the first log. But if taper above this first log differs from the Mesavage-Girard taper rates, volume will also differ.

The author first compared measured taper above the first log with Mesavage-Girard taper rates. The measurements of 357 white and red pine trees (cut in York County, Maine, in 1941) were used. Every effort was made to obtain data comparable to the taper rates reported by Mesavage and Girard. The problem was in estimating merchantable height.

(Mesavage and Girard define merchantable height as the "...point...at which merchantability for saw timber is limited by branches, deformity, or minimum diameter... usually not less than 60...(to)...40 percent ...(of d.b.h.)..." For many trees this definition is not precise: a zone of several feet may be in question. The ambiguity may be heightened by log-grading when the minimum

standards of a grade-3 log are not met in the section just below this limit. In this study, merchantable height was usually the height to which the tree was actually cut for sawlogs. Some variation occurred from attempts to apply the Mesavage-Girard definition.)

Results of the author's comparisons (fig. 1) show that the upper logs of these pine trees taper more than the trees that Mesavage and Girard based their tables on. The differences were so large (as much as 100 percent) that it seems possible an additional log may have been cut from these Maine pines, beyond the merchantability limit defined by Mesavage and Girard.

To test this possibility, the author compared second-from-top logs of the measured trees with top-log rates reported by Mesavage and Girard. He found that second-from-top logs of his measured trees had a significantly greater taper than Mesavage and Girard reported for their top logs. Thus it was impossible to obtain agreement with the Mesavage-Girard rates even by ignoring the top logs that were cut from the measured trees.

Of course there was a possibility that these white pines from York County, Maine, might taper more than other northern conifers. Therefore the taper rates of these pines were compared with the taper of other northern conifers cut in Maine, New Hampshire, Vermont, and New York at various times during

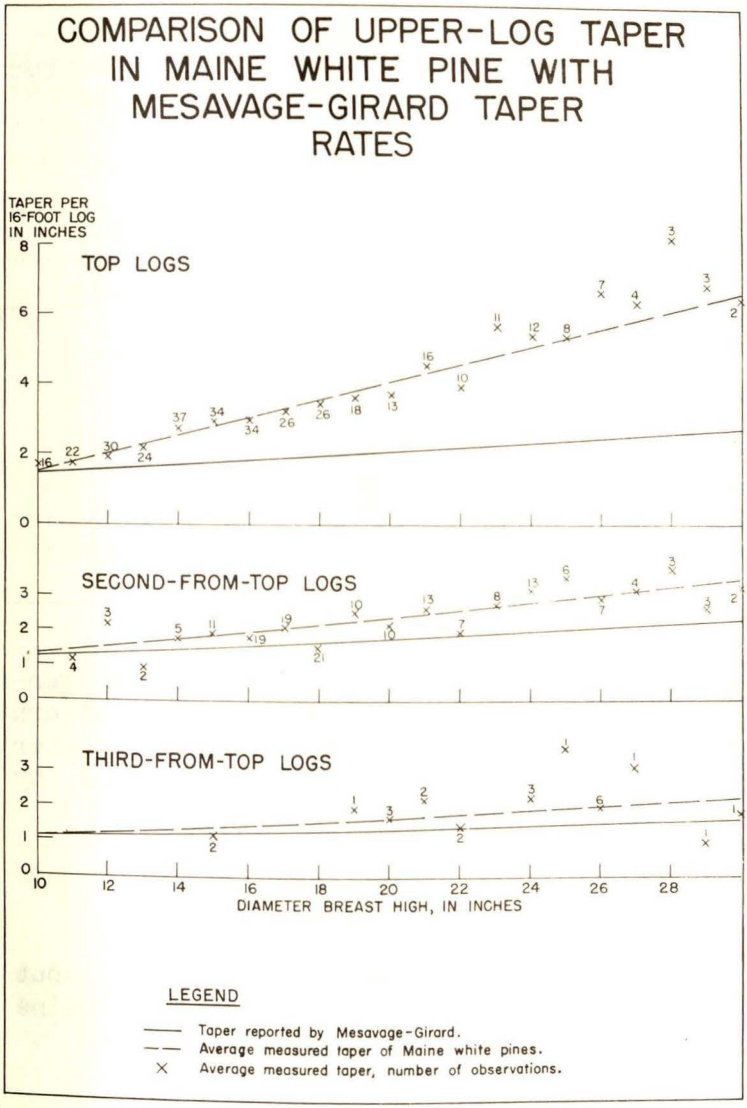
COMPARISON OF UPPER-LOG TAPER IN MAINE WHITE PINE WITH MESAVAGE-GIRARD TAPER RATES
TAPER PER 16-FOOT LOG IN INCHES
TOP LOGS
SECOND-FROM-TOP LOGS
THIRD-FROM-TOP LOGS
DIAMETER BREAST HIGH, IN INCHES
LEGEND
Taper reported by Mesavage-Girard.
Average measured taper of Maine white pines.
Average measured taper, number of observations.

Figure 1.--Comparisons show that northern conifers taper more than the trees Mesavage and Girard based their tables on.

Table 1.--Volume computed from measured taper rates of northern conifers, as a percentage of Mesavage-Girard volume, International ¼-inch rule

(Girard form class 76)

D.b.h.	Merchantable height, in 16-foot logs			
	2	3	4	5
10	95	--	--	--
12	98	--	--	--
14	94	90	--	--
16	93	87	--	--
18	92	87	85	--
20	92	86	84	--
22	92	86	84	--
24	92	86	84	--
26	90	84	82	--
28	90	83	81	78
30	90	83	82	78

the last 50 years. The differences were generally small. But for all these northern conifers, the taper was significantly greater than the taper of the trees studied by Mesavage and Girard.[2]

Volume

Applying the Mesavage-Girard method, but using taper rates from the measured Maine

[2] BUT SIMILAR TESTS OF MANY HARDWOOD SPECIES IN THESE STATES AND IN PENNSYLVANIA AND WEST VIRGINIA HAVE SHOWN NO SIGNIFICANT DIFFERENCES IN UPPER-LOG TAPER FROM THE RATES REPORTED BY MESAVAGE AND GIRARD.

pines, the author computed volumes for these trees. These volumes (for form class 76) are compared with Mesavage-Girard volumes in table 1.

These differences show the error that may result from using Mesavage-Girard tables in estimating the volume of northern conifers. Cruisers who use them will find that they overestimate actual volume by as much as 20 percent.

Mesavage and Girard realized that use of their tables would result in over-scaling if height included the small tops to which northern conifers are often used.

ADJUSTING MESAVAGE-GIRARD TABLES IS NOT SATISFACTORY

SO BEFORE YOU can use Mesavage-Girard tables in northern conifers, you must adjust them to correct this error.

For approximate estimates, you can work up volumes for two classes: 1-log trees, and taller trees. The first class needs no correction. But for the second class, you should drop down one to seven form classes (as Mesavage and Girard suggest), depending on distribution by diameter and height; this should give you a usable estimate.

You could get better results by adjusting for each d.b.h. and height class according to table 1. For example, if average form class is 76, use form class 74 for 10-inch, 2-log trees; form class 75 for 12-inch, 2-log trees; form class 73 for 14-inch, 3-log trees; and so on. For other form classes, similar tables should be prepared.

But any of these adjustments are rather clumsy. It is evident that there is no easy way to adjust these tables so they can be used in northern conifers.

NEW VOLUME TABLES FOR NORTHERN CONIFERS

AN ENTIRELY NEW series of tables seemed to be the easiest way to meet this problem. Therefore the author has prepared such a series of tables (based on Girard form class definition of diameter inside bark at top of first log), using the measured data from the Maine pines as a basis for upper-log taper.[3] Taper rates used are shown in table 2.

The new tables are shown here as tables 3 to 24. They show board-foot volumes (Inter-

[3] AVERAGE TAPER RATES WERE OBTAINED BY FITTING EQUATIONS: (1) A STRAIGHT LINE FOR TAPER PER LOG OVER D.B.H. AND (2) A PARABOLA FOR D.I.B. OVER LENGTH FROM TOP.

national $\frac{1}{4}$-inch rule)[4] for northern conifers of average taper. Volumes were computed for form classes 66, 70, 74, 78, 82, and 86. Volumes for other form classes were obtained by simple interpolation.

All volumes were based on a minimum top diameter of 6 inches.

Table 2.--Average upper-log taper per 16 feet of northern conifers

D.b.h.	Top logs	Second-from-top logs	Third-from-top logs	Fourth-from-top logs
	Inches	Inches	Inches	Inches
10	1.57	--	--	--
12	2.03	1.56	--	--
14	2.49	1.85	--	--
16	2.96	2.14	1.75	--
18	3.42	2.44	1.98	--
20	3.88	2.74	2.21	--
22	4.35	3.04	2.44	2.14
24	4.81	3.33	2.67	2.34
26	5.28	3.63	2.88	2.53
28	5.74	3.93	3.11	2.72
30	6.20	4.22	3.34	2.92

[4] VOLUMES ACCORDING TO INTERNATIONAL 1/4-INCH RULE WERE COMPUTED BY USING $0.3982D^2 - 1.086D - 0.2715$ FOR HALF LOGS. D.I.B. WAS ESTIMATED BY HALF-LOG SECTIONS.

APPLICATION

THESE NEW TABLES should produce volume estimates that agree well with actual volume cut. In using them you still must measure Girard form class and must check a sample of upper-log taper to make sure the rates used in the tables apply to the stand you are cruising.

Girard form class is best determined by measuring diameter outside bark at the top of the first log and adjusting for double bark thickness. Calipers, tape, or binoculars may be used to measure this diameter.

Where moderate precision is acceptable, averages of form classes by species should suffice. You should measure about 30 trees of assorted diameters to determine this average. If greater precision is needed, a larger sample should be measured, say 100 to 150 trees. These data should be taken to permit testing for correlation of form class with merchantable height and diameter. Data used in preparing the new tables suggest that form class increases with merchantable height and, within a height class, decreases with greater d.b.h.

Certainly the advantages of tables based on Girard form class for estimating board-foot volume should make any timber cruiser

reluctant to reject them. Their basic simplicity and the apparent need for using only two rates (one for softwoods, one for hardwoods) of upper log-taper make them easy to apply.

Using these new tables based on Girard form class, the timber cruiser should be able to go into a new stand and measure its volume with confidence--and with fewer and simpler checks.

The new tables follow.

Table 3.--FORM CLASS 65: board-foot volume in northern conifers of average taper, International $\frac{1}{4}$-inch rule

D.b.h.	Estimated merchantable height, in 16-foot logs								
	1	1½	2	2½	3	3½	4	4½	5
10	23	30	--	--	--	--	--	--	--
12	37	47	55	--	--	--	--	--	--
14	51	66	77	86	--	--	--	--	--
16	72	93	106	120	--	--	--	--	--
18	92	119	139	156	170	--	--	--	--
20	115	150	176	198	214	--	--	--	--
22	141	184	216	243	265	285	--	--	--
24	170	223	262	294	323	347	--	--	--
26	204	267	313	352	388	420	--	--	--
28	238	311	364	412	454	490	--	--	--
30	275	360	425	477	525	569	606	--	--

Table 4.--FORM CLASS 66: board-foot volume in northern conifers of average taper, International $\frac{1}{4}$-inch rule

D.b.h.	Estimated merchantable height, in 16-foot logs								
	1	1½	2	2½	3	3½	4	4½	5
10	24	31	--	--	--	--	--	--	--
12	38	49	57	--	--	--	--	--	--
14	53	69	81	90	--	--	--	--	--
16	74	96	111	125	--	--	--	--	--
18	95	124	145	163	178	--	--	--	--
20	119	156	183	206	224	--	--	--	--
22	146	191	225	253	277	298	--	--	--
24	176	231	272	306	337	363	--	--	--
26	211	276	325	366	404	437	--	--	--
28	246	322	379	429	473	511	546	--	--
30	284	373	441	496	547	593	633	--	--

Table 5.--FORM CLASS 67: board-foot volume in northern conifers of average taper, International $\frac{1}{4}$-inch rule

D.b.h.	Estimated merchantable height, in 16-foot logs								
	1	1½	2	2½	3	3½	4	4½	5
10	25	32	--	--	--	--	--	--	--
12	39	50	59	--	--	--	--	--	--
14	56	72	84	94	--	--	--	--	--
16	75	99	115	129	142	--	--	--	--
18	97	128	150	169	185	--	--	--	--
20	123	161	190	214	233	251	--	--	--
22	151	198	234	263	289	311	--	--	--
24	183	239	282	318	350	378	--	--	--
26	216	285	336	380	419	454	483	--	--
28	254	333	393	445	491	532	569	--	--
30	293	386	456	515	569	617	659	--	--

Table 6.--FORM CLASS 68: board-foot volume in northern conifers of average taper, International $\frac{1}{4}$-inch rule

D.b.h.	Estimated merchantable height, in 16-foot logs								
	1	$1\frac{1}{2}$	2	$2\frac{1}{2}$	3	$3\frac{1}{2}$	4	$4\frac{1}{2}$	5
10	26	33	--	--	--	--	--	--	--
12	41	52	61	--	--	--	--	--	--
14	58	75	88	98	--	--	--	--	--
16	78	102	120	134	148	--	--	--	--
18	100	133	156	176	193	--	--	--	--
20	127	167	197	222	243	262	--	--	--
22	157	205	243	273	301	324	--	--	--
24	188	247	293	330	364	394	--	--	--
26	224	294	348	394	435	471	502	--	--
28	260	344	408	462	510	553	592	--	--
30	302	399	472	534	591	641	686	--	--

Table 7.--FORM CLASS 69: board-foot volume in northern conifers of average taper, International ¼-inch rule

D.b.h.	Estimated merchantable height, in 16-foot logs								
	1	1½	2	2½	3	3½	4	4½	5
10	27	34	--	--	--	--	--	--	--
12	42	54	63	--	--	--	--	--	--
14	60	78	91	102	--	--	--	--	--
16	80	105	124	139	153	--	--	--	--
18	104	137	162	182	200	--	--	--	--
20	131	173	204	230	252	273	--	--	--
22	162	212	252	283	313	337	--	--	--
24	195	255	303	342	378	410	437	--	--
26	229	303	360	408	450	488	521	--	--
28	269	355	422	478	529	574	615	--	--
30	311	412	488	553	613	665	713	--	--

Table 8.--FORM CLASS 70: board-foot volume in northern conifers of average taper, International $\frac{1}{4}$-inch rule

D.b.h.	Estimated merchantable height, in 16-foot logs								
	1	1½	2	2½	3	3½	4	4½	5
10	28	36	--	--	--	--	--	--	--
12	43	56	66	73	--	--	--	--	--
14	62	81	95	107	--	--	--	--	--
16	83	109	129	144	159	--	--	--	--
18	108	142	168	189	208	224	--	--	--
20	136	179	212	238	262	284	--	--	--
22	166	219	261	294	325	350	375	--	--
24	200	264	314	355	392	426	454	--	--
26	237	313	372	422	466	506	541	--	--
28	278	367	437	495	548	596	638	--	--
30	321	425	504	572	635	690	740	783	--

Table 9.--FORM CLASS 71: board-foot volume in northern conifers of average taper, International $\frac{1}{4}$-inch rule

D.b.h.	Estimated merchantable height, in 16-foot logs								
	1	1½	2	2½	3	3½	4	4½	5
10	29	37	--	--	--	--	--	--	--
12	45	58	69	76	--	--	--	--	--
14	63	84	98	111	122	--	--	--	--
16	87	112	133	149	165	--	--	--	--
18	112	146	173	196	216	233	--	--	--
20	140	185	219	247	272	295	--	--	--
22	171	226	270	305	337	364	390	--	--
24	205	273	325	368	407	442	472	--	--
26	246	323	385	435	483	525	562	--	--
28	287	378	451	512	568	618	662	702	--
30	331	439	521	593	658	716	768	814	--

Table 10.--FORM CLASS 72: board-foot volume in northern conifers of average taper, International $\frac{1}{4}$-inch rule

D.b.h.	Estimated merchantable height, in 16-foot logs								
	1	$1\frac{1}{2}$	2	$2\frac{1}{2}$	3	$3\frac{1}{2}$	4	$4\frac{1}{2}$	5
10	30	39	45	--	--	--	--	--	--
12	46	60	72	80	--	--	--	--	--
14	66	87	102	116	127	--	--	--	--
16	88	116	138	155	171	--	--	--	--
18	115	151	179	203	224	242	--	--	--
20	144	191	227	256	283	306	327	--	--
22	176	234	279	316	350	378	405	--	--
24	213	282	336	382	422	459	491	--	--
26	251	333	398	452	501	545	584	621	--
28	296	390	466	530	588	640	687	729	--
30	341	453	539	614	681	743	797	846	--

Table 11.--FORM CLASS 73: board-foot volume in northern conifers of average taper, International $\frac{1}{4}$-inch rule

D.b.h.	Estimated merchantable height, in 16-foot logs								
	1	1½	2	2½	3	3½	4	4½	5
10	31	40	47	--	--	--	--	--	--
12	48	62	75	83	--	--	--	--	--
14	68	90	106	120	131	--	--	--	--
16	92	119	142	161	177	190	--	--	--
18	117	155	185	210	232	251	--	--	--
20	148	197	234	265	294	317	339	--	--
22	183	242	288	327	362	392	420	--	--
24	219	291	347	395	437	476	510	--	--
26	260	343	411	467	519	564	606	644	--
28	302	402	481	548	608	662	711	755	--
30	351	467	556	635	704	769	826	877	--

Table 12.--FORM CLASS 74: board-foot volume in northern conifers of average taper, International $\frac{1}{4}$-inch rule

D.b.h.	Estimated merchantable height, in 16-foot logs								
	1	1½	2	2½	3	3½	4	4½	5
10	32	42	49	--	--	--	--	--	--
12	50	65	78	87	--	--	--	--	--
14	71	93	110	125	136	--	--	--	--
16	93	123	147	167	183	197	--	--	--
18	121	160	191	217	240	260	--	--	--
20	153	203	242	275	305	329	352	--	--
22	188	250	297	338	375	407	435	--	--
24	226	300	359	409	453	493	529	562	--
26	266	354	424	482	537	584	628	667	--
28	311	414	496	566	629	684	736	782	--
30	361	481	574	656	727	796	855	909	958

Table 13.--FORM CLASS 75: board-foot volume in northern conifers of average taper, International ¼-inch rule

D.b.h.	Estimated merchantable height, in 16-foot logs								
	1	1½	2	2½	3	3½	4	4½	5
10	33	43	50	--	--	--	--	--	--
12	51	67	80	89	--	--	--	--	--
14	72	95	113	128	141	--	--	--	--
16	97	127	152	173	190	205	--	--	--
18	125	165	197	224	249	270	288	--	--
20	157	209	250	284	315	341	365	--	--
22	193	258	307	350	388	422	452	479	--
24	232	309	370	422	469	510	548	582	--
26	275	365	438	499	556	606	651	692	--
28	321	426	512	585	650	708	763	811	--
30	371	495	592	678	752	824	886	943	994

Table 14.--FORM CLASS 76: board-foot volume in northern conifers of average taper, International $\frac{1}{4}$-inch rule

D.b.h.	Estimated merchantable height, in 16-foot logs								
	1	$1\frac{1}{2}$	2	$2\frac{1}{2}$	3	$3\frac{1}{2}$	4	$4\frac{1}{2}$	5
10	34	45	52	--	--	--	--	--	--
12	52	69	83	92	--	--	--	--	--
14	74	98	117	132	146	--	--	--	--
16	100	132	157	179	197	214	--	--	--
18	129	171	204	232	258	280	299	--	--
20	162	216	258	294	326	354	379	--	--
22	198	266	317	362	402	437	469	498	--
24	237	319	382	436	485	528	567	603	--
26	284	377	452	516	575	628	675	717	--
28	331	439	528	604	672	733	790	840	886
30	381	510	611	700	778	852	917	977	1,031

Table 15.--FORM CLASS 77: board-foot volume in northern conifers of average taper, International $\frac{1}{4}$-inch rule

D.b.h.	Estimated merchantable height, in 16-foot logs								
	1	1½	2	2½	3	3½	4	4½	5
10	35	46	54	61	--	--	--	--	--
12	54	71	85	95	--	--	--	--	--
14	77	101	120	136	151	162	--	--	--
16	102	136	162	185	204	222	--	--	--
18	133	176	210	240	267	290	310	--	--
20	166	222	266	303	337	366	393	416	--
22	203	274	327	374	416	452	486	516	--
24	246	328	394	449	501	545	586	623	--
26	290	388	466	533	594	650	698	742	784
28	341	451	544	623	694	758	817	869	917
30	392	525	629	722	804	880	948	1,011	1,067

Table 16.--FORM CLASS 78: board-foot volume in northern conifers of average taper, International ¼-inch rule

D.b.h.	Estimated merchantable height, in 16-foot logs								
	1	1½	2	2½	3	3½	4	4½	5
10	36	48	56	63	--	--	--	--	--
12	56	74	88	98	109	--	--	--	--
14	78	104	124	140	156	167	--	--	--
16	106	141	168	192	212	231	247	--	--
18	136	182	217	248	276	300	321	--	--
20	171	229	275	313	348	379	407	431	--
22	211	282	337	387	430	467	503	535	--
24	252	338	406	463	517	563	606	644	681
26	299	400	480	550	614	672	722	768	814
28	347	464	560	642	716	783	844	898	948
30	403	540	648	744	830	909	980	1,045	1,104

Table 17.--FORM CLASS 79: board-foot volume in northern conifers of average taper, International ¼-inch rule

D.b.h.	Estimated merchantable height, in 16-foot logs								
	1	1½	2	2½	3	3½	4	4½	5
10	38	49	58	65	--	--	--	--	--
12	58	76	90	101	112	--	--	--	--
14	82	107	128	145	161	174	--	--	--
16	108	145	173	198	219	238	256	--	--
18	140	187	224	256	285	310	333	--	--
20	176	235	283	323	359	391	421	446	--
22	216	289	347	398	443	483	520	553	--
24	260	347	418	478	534	582	627	667	705
26	305	411	494	567	633	693	746	795	842
28	357	478	577	662	740	810	873	930	982
30	413	555	667	767	857	939	1,013	1,081	1,143

Table 18.--FORM CLASS 80: board-foot volume in northern conifers of average taper, International $\frac{1}{4}$-inch rule

D.b.h.	Estimated merchantable height, in 16-foot logs								
	1	1½	2	2½	3	3½	4	4½	5
10	39	51	60	68	--	--	--	--	--
12	59	78	93	105	116	--	--	--	--
14	83	110	133	151	167	180	--	--	--
16	112	149	178	204	226	246	265	--	--
18	144	193	231	265	295	321	345	367	--
20	181	242	291	333	371	404	435	462	--
22	221	297	357	410	457	499	537	571	602
24	266	357	431	494	551	602	649	691	729
26	315	423	509	585	652	715	771	822	870
28	367	493	595	683	765	837	902	963	1,017
30	424	571	687	791	884	969	1,046	1,117	1,182

Table 19.--FORM CLASS 81: board-foot volume in northern conifers of average taper, International $\frac{1}{4}$-inch rule

D.b.h.	Estimated merchantable height, in 16-foot logs								
	1	1½	2	2½	3	3½	4	4½	5
10	40	52	62	71	--	--	--	--	--
12	60	80	96	109	120	--	--	--	--
14	85	113	137	156	172	187	--	--	--
16	115	153	183	210	233	254	274	--	--
18	148	199	238	274	305	332	357	380	--
20	185	249	299	343	382	417	449	478	--
22	227	304	367	422	470	515	554	589	622
24	272	367	443	509	568	622	671	714	753
26	324	434	523	602	671	737	795	849	898
28	378	507	612	703	790	864	931	996	1,051
30	435	587	707	815	911	999	1,079	1,153	1,221

Table 20.--FORM CLASS 82: board-foot volume in northern conifers of average taper, International $\frac{1}{4}$-inch rule

D.b.h.	Estimated merchantable height, in 16-foot logs								
	1	1½	2	2½	3	3½	4	4½	5
10	41	54	65	74	--	--	--	--	--
12	62	82	99	113	124	134	--	--	--
14	88	117	142	162	178	194	208	--	--
16	117	157	189	216	241	262	283	--	--
18	153	205	246	283	315	343	369	393	--
20	190	256	308	354	394	430	463	494	518
22	232	312	378	434	484	531	572	608	643
24	281	377	456	525	585	642	693	738	777
26	331	446	538	620	691	759	820	876	926
28	388	522	630	724	815	891	961	1,029	1,086
30	447	603	727	839	938	1,029	1,112	1,189	1,260

Table 21.--FORM CLASS 83: board-foot volume in northern conifers of average taper, International ¼-inch rule

D.b.h.	Estimated merchantable height, in 16-foot logs								
	1	1½	2	2½	3	3½	4	4½	5
10	42	55	67	76	--	--	--	--	--
12	65	84	102	116	128	139	--	--	--
14	90	120	146	167	184	200	214	--	--
16	121	161	194	223	249	271	292	310	--
18	155	210	253	291	324	354	381	406	--
20	195	263	317	365	406	445	479	510	537
22	240	320	389	447	499	547	590	629	665
24	287	387	468	539	602	661	716	761	803
26	341	458	554	639	713	784	847	906	957
28	395	536	647	746	839	918	992	1,063	1,123
30	458	619	748	863	966	1,061	1,148	1,228	1,301

Table 22.--FORM CLASS 84: board-foot volume in northern conifers of average taper, International ¼-inch rule

D.b.h.	Estimated merchantable height, in 16-foot logs								
	1	1½	2	2½	3	3½	4	4½	5
10	43	57	69	79	86	--	--	--	--
12	66	87	105	120	132	144	--	--	--
14	93	124	150	172	190	207	221	--	--
16	123	166	200	230	258	280	301	321	--
18	160	216	261	300	334	365	393	419	--
20	200	270	327	376	419	460	495	527	557
22	246	329	400	460	514	564	609	650	687
24	296	397	481	554	620	681	739	785	829
26	347	471	570	658	736	809	875	936	989
28	406	550	665	768	864	946	1,024	1,097	1,160
30	470	635	769	887	995	1,094	1,184	1,267	1,343

Table 23.--FORM CLASS 85: board-foot volume in northern conifers of average taper, International $\frac{1}{4}$-inch rule

D.b.h.	Estimated merchantable height, in 16-foot logs								
	1	1½	2	2½	3	3½	4	4½	5
10	45	59	71	81	90	--	--	--	--
12	68	91	108	124	136	149	--	--	--
14	95	127	154	177	196	214	228	--	--
16	127	171	206	237	266	289	311	332	--
18	164	222	268	308	344	376	405	432	456
20	205	277	336	387	432	475	511	544	576
22	251	338	411	473	529	581	627	671	709
24	302	407	493	569	637	700	759	809	855
26	357	484	586	677	758	834	903	966	1,020
28	417	564	683	790	888	974	1,056	1,131	1,197
30	481	651	790	911	1,023	1,126	1,220	1,306	1,384

Table 24.--FORM CLASS 86: board-foot volume in northern conifers of average taper, International $\frac{1}{4}$-inch rule

D.b.h.	Estimated merchantable height, in 16-foot logs								
	1	1½	2	2½	3	3½	4	4½	5
10	46	61	74	84	94	--	--	--	--
12	69	92	112	128	141	155	--	--	--
14	97	131	158	182	203	221	235	--	--
16	131	176	212	245	275	298	321	343	--
18	169	228	276	317	354	388	418	446	470
20	211	285	346	398	445	490	527	561	596
22	257	347	422	487	545	598	646	693	732
24	308	417	506	584	655	720	779	833	882
26	368	497	603	696	781	859	931	996	1,052
28	428	579	701	813	913	1,002	1,088	1,165	1,234
30	493	668	812	936	1,052	1,159	1,257	1,346	1,426